Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) An assembly comprising:
an x-ray tube ~~(1)~~ including:
an envelope ~~(14)~~ which defines an evacuated chamber in which x-rays are generated ~~(12)~~;
a housing ~~(30)~~ which surrounds at least a portion of the envelope;
a cooling system ~~(32, 32')~~ which circulates a coolant through the housing to remove heat from the x-ray tube, the cooling system including:
a pump~~(40, 40')~~; and
a flow sensor system ~~(60, 60')~~ which is responsive to a pressure difference across the pump

2 (Currently amended) The assembly of claim 1, wherein the flow sensor system includes a differential pressure transducer ~~(60, 60')~~.

3. (Currently amended) The assembly of claim 1, wherein the cooling system ~~(32, 32')~~ further includes:
a recirculating fluid flow path ~~(33, 33')~~ including a first fluid line ~~(34, 34')~~ which connects the housing ~~(30)~~ with an upstream end of the pump ~~(40, 40')~~ and a second fluid line ~~(50, 50' 36, 36')~~ which connects a downstream end of the pump with the housing, the flow sensor system being responsive to a pressure difference between the first fluid line and the second fluid line.

4. (Original) The assembly of claim 1, wherein the flow sensor system detects a first pressure upstream of the pump and a second pressure downstream of the pump.

5 (Currently amended) The assembly of claim 1, further including a processor ~~(80, 80')~~ which receives a signal from the flow sensor system correlated with the pressure difference, the processor determining a flow rate of cooling fluid therefrom.

6. (Currently amended) The assembly of claim 5, further including:
a control means ~~(81, 81', 82, 82', 107)~~, the control means controlling operation of the x-ray tube in the event that the determined flow rate is below a preselected minimum level.

7. (Currently amended) The assembly of claim 5, further including:
a control means ~~(81, 81', 82, 82', 107)~~ responsive to the pressure difference controlling at least one of:
operating power of the x-ray tube;
operating time of the x-ray tube;
selectable scan protocols; and
a cooling period prior to subsequent operating of the x-ray tube

8. (Currently amended) The assembly of claim 1, further including:
a temperature sensor ~~(90, 92)~~ which senses a temperature of circulating coolant in at least one of the housing and the cooling system.

9. (Currently amended) The assembly of claim 8, further including:
a processor ~~(80')~~ which receives signals from the temperature sensor ~~(90, 92)~~ and flow sensor system ~~(60')~~ and determines an indication of thermal loading or remaining thermal capacity of the cooling system.

10. (Currently amended) The assembly of claim 9, wherein the processor ~~(80')~~ determines a cooling period, based on the determined indication, x-ray tube power, operating time, and duty cycle of a planned scan protocol to ensure that the x-ray tube is capable of performing the planned protocol without overheating.

11. (Currently amended) A CT-scanner ~~(100)~~ including the assembly of claim 1.

12. (Currently amended) A CT-scanner ~~(100)~~ comprising:
the assembly of claim 1;
an x-ray detector;
a scan processor; and
a display.

13 (Currently amended) A method for controlling operation of an x-ray tube ~~(1)~~, the method comprising:
circulating a cooling fluid through a housing ~~(30)~~ and over the x-ray tube with a pump ~~(40)~~;
removing heat from the cooling fluid which has circulated through the housing; and
determining a flow rate of the cooling fluid, including:
determining a pressure difference across the pump or a function which correlates with the pressure difference, and
determining the flow rate from the pressure difference or function

14. (Original) The method of claim 13, further including:
in the event that the flow rate drops below a predetermined minimum value, reducing power to the x-ray tube

15 (Original) The method of claim 13, further including:
determining a temperature of the cooling fluid

16. (Original) The method of claim 15, further including:
determining a temperature difference.

17 (Original) The method of claim 15, further including:
determining a thermal loading condition of the x-ray tube from the determined temperature and flow rate.

18. (Original) The method of claim 17, further including:

in response to the determined thermal loading condition, controlling at least one of:

operating power of the x-ray tube;

operating time of the x-ray tube;

selectable scan protocols; and,

a cooling time prior to subsequent operating of the x-ray tube.

19 (Currently amended) A system for removing heat from an associated x-ray tube ~~(1)~~ comprising:

a fluid flow path ~~(33, 33')~~ which carries a cooling fluid to at least a portion of the associated x-ray tube, and removes heat therefrom;

a pump ~~(40, 40')~~ which circulates the cooling fluid through the fluid flow path;

means ~~(52, 52')~~ for determining a pressure difference across the pump; and

means ~~(81, 81', 82, 82', 107)~~ responsive to the determined pressure difference for controlling operation of the x-ray tube.

20. (Currently amended) The system of claim 19, wherein the determining means ~~(52, 52')~~ includes:

a means ~~(60, 60')~~ for measuring a pressure difference across the pump ~~(40, 40')~~; and

a means ~~(80, 80')~~ for determining cooling fluid flow rate from the determined pressure difference.

21. (Currently amended) The system of claim 20, further including:

means ~~(90, 92)~~ for determining a temperature of the cooling fluid; and

the means ~~(81', 82)~~ for controlling also being responsive to the determined temperature.

22. (Currently amended) The system of claim 21, further including:

a means ~~(120)~~ for selecting a scan protocol;

a means ~~(107)~~ for implementing a scan with the selected scan protocol;

the controlling means ~~(81, 81', 82, 82')~~ in accordance with the determining flow rate and temperature controls at least one of:

operating power of the x-ray tube;

operating time of the x-ray tube; and

selectable scan protocols